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LIVESAFE and healthy lives!

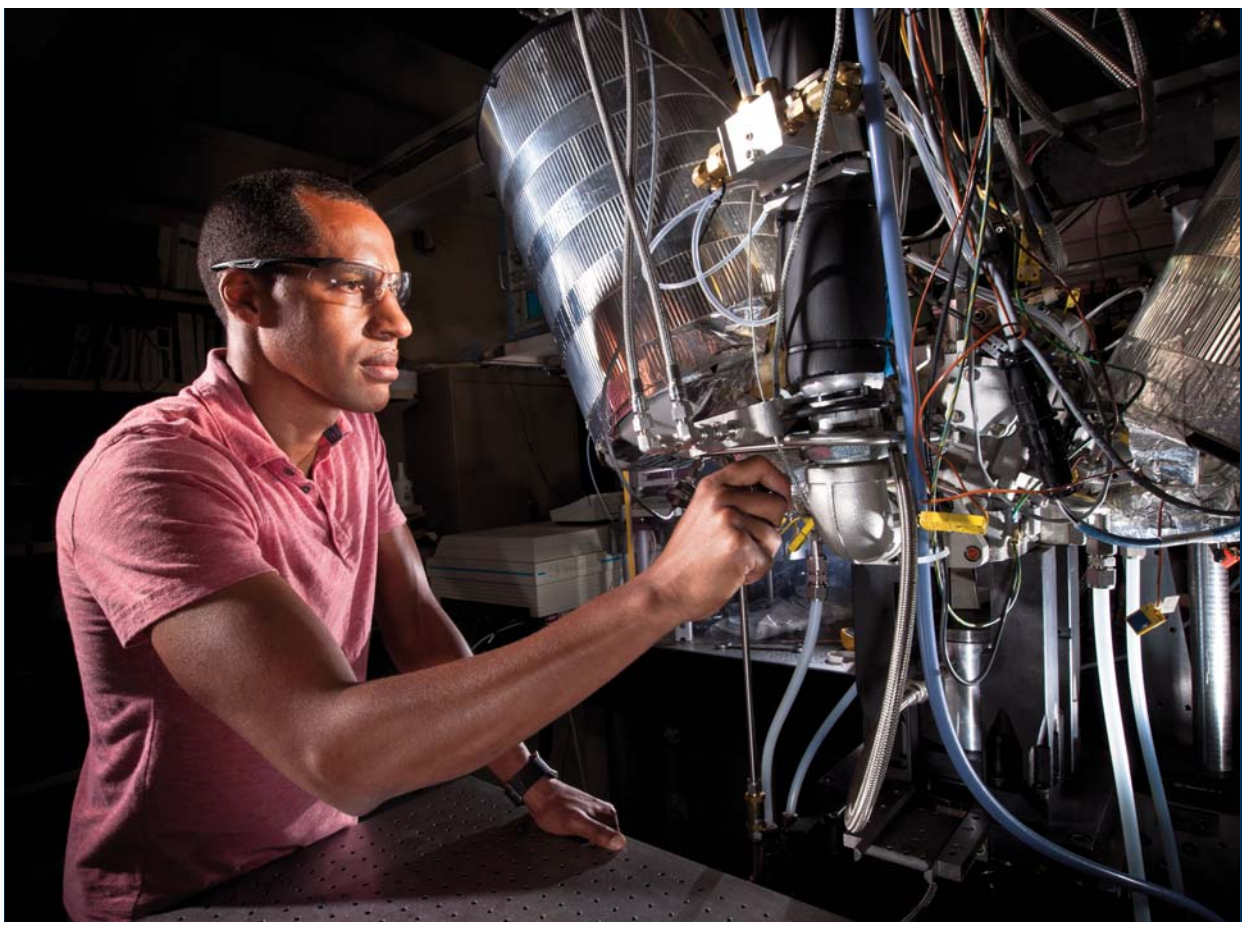
Celebrating Sandia's Values

SAFE & HEALTHY LIVES MONTH

Info on page 2

A burning question

Sandia explores aggressive high-efficiency sparkplug-free gasoline auto engines



By Michael Padilla

Researchers at Sandia's Combustion Research Facility are playing a key role in developing sparkplug-free engines that will help meet ambitious automotive fuel economy targets of 54.5 miles per gallon by 2025.

They are working on low-temperature gasoline combustion (LTGC) operating strategies for affordable, high-efficiency engines that will meet stringent air-quality standards.

Sandia researchers Isaac Ekoto and Benjamin Wolk (both 8632) say the goal of the LTGC project is an engine in which chemically controlled ignition initiates the combustion of dilute charge mixtures.

"The use of dilute mixtures avoids high flame temperatures that can lead to nitrogen oxide formation," Isaac says. "LTGC operation increases engine efficiency relative to conventional spark-ignited gasoline engines through reduced heat transfer and pumping losses, along with increased conversion of fuel chemical energy into usable work via higher compression ratios and mixture-specific heat ratios."

Overcoming slow burn-rate misfires

The research challenge has been to achieve effective autoignition control when an engine is idling or at other low-load operating conditions, where slow burn rates can cause frequent misfires.

The research was published in the September 2015 issue of the *SAE International Journal of Fuels and Lubricants* in a paper titled "Detailed Characterization of Negative Valve Overlap Chemistry by Photoionization Mass Spectroscopy." The work was recognized by the Society of Automotive Engineers of Japan (JSAE) as the best paper of 2015.

(Continued on page 4)

ISAAC EKOTO IS PART OF A SANDIA TEAM that is playing a key role in the effort to develop sparkplug-free engines that could help automakers meet ambitious fuel standards by 2025. (Photo by Randy Wong)

Lessons from Fukushima

Sandia helps spread lessons learned from Japanese reactor accident

By Stephanie Holinka

When you're an operator or engineer at a nuclear power plant, there are things you want to know long before you're faced with an emergency.

The Technical Support Guidelines (TSG) Skillset Workshops, developed by the General Electric Boiling Water Reactor (BWR) Owner's Group, bring together experts from Sandia and other places who share with engineers/operators the lessons learned in the wake of the Fukushima Daiichi nuclear accident and other severe accidents at nuclear power plants that pushed the facilities past their conceivable limits.

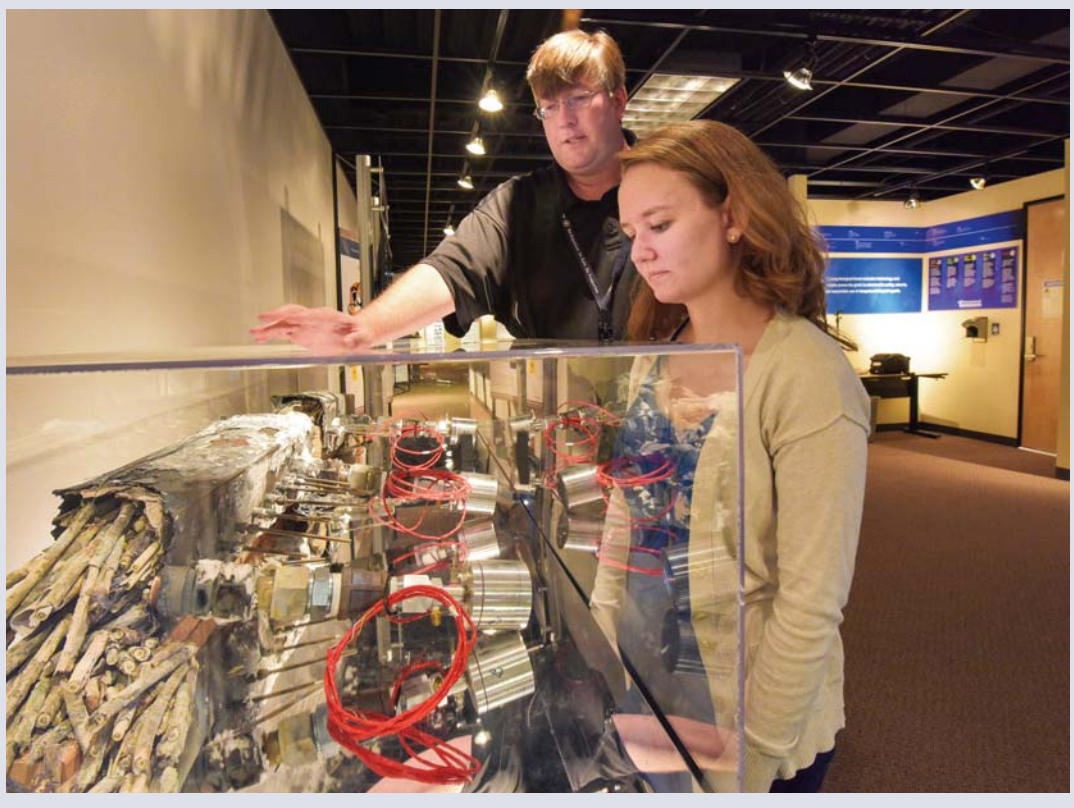
The workshops seek to demystify what actually happens during an accident, to help engineers/operators learn what types of decisions might need to be made in the event of an accident at their plant, and to provide insights into the non-intuitive nature of accidents. To date, workshops have been held in Taiwan, Japan, and the US, with additional workshops planned for Switzerland, Mexico, Spain, and the US.

What to expect next

"By walking participants step by step through what happened during a real-world accident, operators/engineers can use that information to know where they are in the accident process, so they know what to expect next, particularly when the accident could progress in ways that are unexpected," says Randy Gauntt, manager of Severe Accident Analysis Dept. 6232.

Sandia brings decades of experience to the workshops. The Labs' analytical software, developed for the US Nuclear Regulatory Commission (NRC), was used by Sandia to advise the NRC, DOE, and TEPCO, the Tokyo Electric Power Company, on the accident progression at the

(Continued on page 4)



NUCLEAR ENGINEER Douglas Osborn (6232) shows student intern Anastasia Fox (6234) the results of an experiment that resulted in the zirconium cladding of a fuel cell catching fire. Douglas is one of the Sandia engineers sharing the lessons learned from mining Fukushima data with nuclear plant operators, to give them the knowledge they'll need in the unlikely event of an accident. (Photo by Randy Montoya)

Innovation Celebration!

NMSBA
Los Alamos National Laboratory
Sandia National Laboratories

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Inside . . .

Early career honors

Melissa Teague has been awarded a Presidential Early Career Award in Science and Engineering, the highest honor the US government bestows on science and engineering professionals in the early stages of their independent research careers. **See page 5.**

That's that

Graduation! It's a rite of passage associated with caps and gowns and cookouts . . . . and words, words, words. Commencement speaker words, valedictorian words, principal and superintendent words, and doting grandparent words.

At this time of year, too, newspaper editorial writers produce their obligatory annual "If I were asked, this is the commencement speech I'd give" column. Whereas most such addresses are intentionally inspirational and unintentionally forgettable, these would-be, never-delivered speeches are usually meant to be aggressively *uninspiring*. The approach is usually, "I'm gonna tell these kids how it *really* is." In that spirit, here's the speech I would give if I were asked.

Greetings. You don't know me but I know you. At least sort of. I've been where you are and it's a fun and gratifying place to be. After a long grind and a lot of hard work, you've earned the right to sit here today and listen to words of wisdom from the likes of me. Yippee!

First of all, I have some good news and some bad news. Which do you want first? The bad? Okay, here it is: Starting today, you have maybe 70 years on this planet to sort everything out and get it right with your friends, your family, your community, your career. Maybe you've read the buzz about extending human lifespans and maybe you'll be beneficiaries of that effort, but I wouldn't count on it. Count on that 70 years, give or take.

And the good news? It's the same deal: You've got maybe 70 years to make the most of your time on this planet. Barring some breakthrough in anti-aging research, you're going to get old, as old as me. And guess what? That ain't so bad, not nearly as a bad as I thought it would be when I was your age. In fact, it's pretty darned good. I wouldn't go back or change anything, except to maybe be kinder to everybody every day.

All of us — you, me, everybody — live in a time machine that we can't escape from, and it moves inexorably forward in one-second increments. As Dylan Thomas wrote, "Time held me green and dying/Though I sang in my chains like the sea."

He was a smart man. He understood. On many a day, you will wake up and sing, at least in your heart; as you get older, the song will be sweeter and sadder but it will still be a song. If you listen closely enough, you can hear music that everyone makes. The notes will be composed, in unequal measure, of joy, grief, elation, loss, pain, and gain. If you're lucky, as I have been, most of the notes will be based on plain old everyday happiness.

There's a presumption that speakers invited to these shindigs know something special. But I'll let you in on a secret. To paraphrase Matt Foley (look him up), I don't know jack squat. Or, allow me to rephrase that: I know a little more than jack squat but less than diddly squat.

I'm not talking about my work here. I get better and more knowledgeable about that every day, and as you progress in your careers you'll get better and better at what you do. You'll keep learning and growing. Hopefully, you'll get to do something you really enjoy, something that you can't believe they pay you to do.

But in "real life" I've learned that everything is more complicated, more nuanced than I thought it was. The certainties of my own youth have yielded to an increased tolerance for ambiguity, an acceptance that people are fallible and make mistakes. But I've learned, too, that just about everybody is more decent than I thought they were back when I was a know-it-all. So here's my first and only bit of real advice: Cut each other some slack. We deserve it.

A few more observations: In a contentious year, don't let politics divide you from friends and family. Keep your priorities straight: It's the people in your lives that matter today and for the rest of your lives.

Want some more? As Kurt Vonnegut *didn't* advise in the commencement speech he *didn't* give but was credited with delivering, use sunscreen and floss every day. Speaking of Vonnegut, in one of his later novels, he cited words of wisdom from three brilliant philosophers, words to live by: "To be is to do" — Socrates; "To do is to be" — Jean-Paul Sartre; "Do be do be do" — Sinatra.

And my final words for you this afternoon: Start saving today for your old age. You won't regret it. And go easy on the pizza and other cheese-based food products. You won't regret that, either.

See you next time.

— Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

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Sandia's core values

Sandia's five core values inform our daily decisions, shape our performance, and enable us to achieve success as one lab.

• **We serve the nation** by responding to our customers' requests and by anticipating our country's future needs. We fulfill our mission of solving national security challenges with commitment to "exceptional service in the national interest."

• **We team to deliver with excellence** by combining our individual talents to meet and exceed our commitments and by pursuing continuous improvement to advance the frontiers of science, engineering, and technology.

• **We respect each other** by cherishing the intellect, skills, diversity, flexibility, and passion of our coworkers, by including one and all. We provide opportunities for the development of all members of our workforce and celebrate their world-class accomplishments, which enable Sandia's mission.

• **We act with integrity** by living within our principles, sharing our views, and doing what is right.

• **We live safe and healthy lives** by using critical thinking in our daily activities; demonstrating that safety and health come first; and striving to eliminate unsafe conditions, prevent injuries, and promote healthy, vibrant lives. We embrace safety and health in all our activities, at work and outside the workplace.

Honoring math, science excellence

Recognition program for high school girls celebrates 25th year at Sandia/California

By Patti Koning

Celeste Rohlfing, chief operating officer at the American Association for the Advancement of Science (AAAS), presented Sandia's 25th annual Math and Science Awards to 28 young women from San Francisco Bay Area high schools. Rohlfing, a chemist at Sandia for 11 years, was one of the founders of the awards.

"I am very proud of the hard work and academic accomplishments of this year's winners," said Marianne Walck, vice president of Sandia's California site. "I hope this award and the connections made with Sandia mentors will inspire and encourage them throughout their professional journeys."

The Math and Science Awards program encourages high-achieving young women to continue studying STEM (science, technology, engineering, and math) subjects and creates mentoring opportunities with Sandia employees. Teachers from 15 northern California high schools in Livermore, Dublin, Pleasanton, Tracy, Lathrop, Manteca, and Oakland nominated students they deemed outstanding in math and science.

"Twenty-five years ago we realized that while young women were excelling in their high school math and science classes, we weren't seeing them in similar numbers in senior positions in industry or academia. The Math and Science Awards was our way of helping to address that problem," said Cathy Branda (8633), one of the awards organizers and manager of the Systems Biology group.

The winners were recognized with certificates from Sandia and State Assemblywoman Catharine Baker.

MAKING THEIR MARK — In the photo at top right, guest speaker Celeste Rohlfing, third from left, front row, is joined by the organizers, speakers, and mentors involved in this year's Math and Science Awards ceremony recognizing young women from San Francisco Bay area high schools. Rohlfing, chief operating officer of the American Association for the Advancement of Science, worked at Sandia for more than a decade and was one of the founders of the award 25 years ago. In the center photo, Rohlfing, at left, joins recipients of math awards and in the bottom photo she stands with young women recognized for achievements in science.

(Photos by Randy Wong)

The winners of the 2016 Sandia Math and Science Awards are:

Outstanding Achievement in Mathematics

- Alyse Coonce, Amador Valley High School
- Ana Lapota, Coliseum College Prep Academy
- Liubou Klindziuk, Dublin High School
- Emily Allendorf, Granada High School
- Rania Ibrahim, John C. Kimball High School
- Ayzher Ocsona, Lathrop High School
- Samantha Dukes, Livermore High School
- Audrey Kurz, Livermore Valley Charter Preparatory
- Jasmine Jaring Angeles, Merrill F. West High School
- Dayanara Salinas, Millennium High School
- Margaret Austin, Oakland Tech High School
- Eunice Han, Skyline High School
- Alexandra Uskov, Tracy High School

Outstanding Achievement in Science

- Sandhya Kalavacherla, Amador Valley High School
- Naomi Montenegro, Coliseum College Prep Academy
- Navya Peddireddy, Dublin High School
- Allison Kifer, Granada High School
- Autumn Armstrong, John C. Kimball High School
- Farhat Khairzadah, Lathrop High School
- Raina Jaing, Livermore High School
- Shannon Meyer, Livermore Valley Charter Preparatory
- Jordan Hensley, Manteca High School
- Jennifer Lukban, Merrill F. West High School
- Alexis Diaz, Millennium High School
- Merissa Bridgeman, Oakland Tech High School
- Miranda Becerra, Sierra High School
- Tiffany Wong, Skyline High School
- Erika Pulliam, Tracy High School

Open mind, innovation keys to future success

Honorees, families, and teachers mingled with Sandia researchers and learned about careers in math and science. Kicking off the ceremony, Rohlfing spoke about the history of the awards program and her career path, which also included serving as the assistant director for physical sciences at the White House Office of Science and Technology and deputy assistant director at the National Science Foundation.

"I gave the inaugural address at the first Math and Science Awards 25 years ago," said Rohlfing. "I am overjoyed to see that these awards have not just endured but become bigger and better."

Rachelle Hamblin (8633) shared her journey from Math and Science awardee to college intern to technologist in the Systems Biology group. She credited her exposure to the people and research at Sandia with inspiring her to pursue a dual medical degree and master's degree in public health at the University of Texas at San Antonio.

She imparted some advice to the awardees for taking advantage of the exciting years to come.

"Keep an open mind, never take 'no' for an answer, be innovative" said Rachelle. "And network, network, network."

Sandia CaliforniaNews
Exceptional service in the national interest

THE FUKUSHIMA REACTOR COMPLEX in Japan suffered catastrophic failure in 2011 in the wake of an earthquake and tsunami. Nuclear engineers, scientists, and industry experts have studied the accident to demystify what actually happens during an accident, to improve emergency response, and to provide insights into the non-intuitive nature of accidents. (Image source: TEPCO)

Lessons from Fukushima

(Continued from page 1)

Fukushima Daiichi site.

Sandia began its studies of responses to severe nuclear accidents shortly after the Three Mile Island incident in Pennsylvania in 1979, an event that radically altered the future of nuclear power in the United States. Since then, Sandia has provided domestic and international industry as well as US and foreign governments regulatory research support into severe reactor accidents for more than 40 years, and serves as the NRC's principal contractor for severe accident research.

Accidents progress in surprising ways

Not all plant accidents are the same. Some things about the Fukushima incident were surprising.

"Pumps that should have failed in a few hours ran for days, well beyond their expected design basis," says Douglas Osborn, a technical staff member in Sandia's Severe Accident Analysis Dept. 6232.

Doug says that in the Fukushima incident, the expected reactions that create hydrogen led to explosions in the Units 1, 3, and 4 reactor buildings.

"As the core heated to temperatures of about 1,832 F (1,000 C), the fuel cladding metal reacted with the steam in an exothermic oxidation reaction, leading to rapid temperature increase to the point where water didn't provide sufficient cooling and created large amounts of hydrogen. The cladding and fuel began to melt, while cladding oxidation continued," Doug says.

Doug says the reactor core material fails at the bottom of the reactor vessel, and the molten core material frees water, hydrogen, carbon monoxide, and carbon dioxide from the concrete as well. When the core material mixed with zirconium and steel oxidizes on the concrete, large quantities of combustible gas, hydrogen and carbon monoxide, can be generated while generating additional heat. The combustible gases may burn above the molten pool or may accumulate with the other gases to pressurize the containment.

Many of these accident progressions are still being analyzed with the data from the Fukushima accident to determine the conditions of the core and provide insights for engineers/operators for preventing another accident.

Training the next generation

The TSG Skillset workshop information assists operators/engineers in understanding severe accident phenomena and timelines, and helps them recognize critical events. It helps them identify constraints and limitations of tools and equipment, including those needed to assess and predict the accident's progression.

"The next generation of nuclear professionals understand better the events that have impacted the industry through lessons this generation has learned," says Bill Williamson, chair of the BWR Owner's Group Emergency Procedures Committee. Williamson is working to ensure that workshops like this one transfer important information that allows interpreting severe accident instrument readings to be more effective for the next generation nuclear professional.

Williamson says severe accident conditions do not lend themselves to simple, easy-to-understand instrument readings, making workshops like this one important.

"Ultimately, we want the operator to know that they aren't alone if an accident occurs at their plant. We want them to know that there are tools to help them, and there are experts that they can turn to," Doug says.

Sparkplug-fee engines

(Continued from page 1)

Creating negative valve overlap to extend engine operation

One method to improve LTGC engine operation at low loads is to employ a negative valve overlap (NVO) strategy.

"Modified valve timings shorten the exhaust stroke and delay opening of the intake valve, so that most of the combustion products from the previous cycle are trapped in the cylinder and mix with the fresh intake charge during the next cycle," Isaac says.

For direct-injection engines, the Sandia team is researching how to enhance auto-ignition further by introducing a small amount of fuel injection during the NVO period. The high temperatures reached during the NVO period — from compression heating of the hot retained burned gases — work to thermally decompose the fuel into a more reactive "reformate" stream laden with hydrogen, carbon monoxide, and small hydrocarbons (e.g., methane, acetylene, ethylene).

Characterizing chemical composition of NVO

To accurately characterize the chemical composition of NVO-generated reformate and its impact on engine performance, Isaac and Benjamin conducted a series of experiments using six different single-component fuels: iso-octane, n-heptane, ethanol, cyclohexane, toluene, and 1-hexene. Each fuel represented the different classes of components found in commercial gasoline. They also evaluated a research-grade gasoline whose composition was well understood and a surrogate that mimicked the research gasoline.

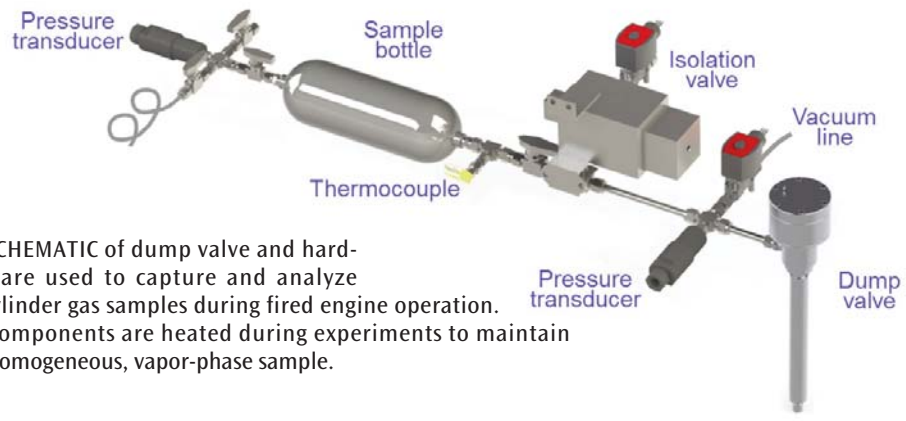
A custom-developed dump sampling valve — designed to fit into an available spark-plug port of a single-cylinder research engine — enabled full-cylinder gas sampling of the reformate. The sampled gas was stored in a cylinder that was preheated to avoid hydrocarbon or water condensation, and was subsequently fed into a gas chromatograph (GC) to identify the light hydrocarbon species present in the reformate.

"Quantifying the concentrations of these species provides valuable insight into how the fuel chemical energy is distributed among the different classes of light hydrocarbons in the reformate," Isaac says.

However, GC measurement doesn't accurately distinguish between species with similar molecular composition, but that have drastically different effects on auto-ignition chemistry. Nils Hansen and Kai Moshammer (both 8353) of Sandia's Combustion Chemistry Department helped perform more detailed characterization of the reformate streams via photoionization mass spectrometry (PIMS).

Measurements performed at Lawrence Berkeley lab

The PIMS measurement, performed at Lawrence Berkeley National Laboratory's Advanced Light Source, used vacuum ultraviolet light to continuously ionize the sample gas in the extraction region of a high-resolution time-of-flight mass spectrometer. The photon energy of the ionized gas was scanned across a range of relevant energies, with resultant ions extracted and detected on a micro-channel plate detector. The team developed an algorithm that identified sample constituents based on their photoionization efficiencies.



SCHEMATIC of dump valve and hardware used to capture and analyze cylinder gas samples during fired engine operation. Components are heated during experiments to maintain homogeneous, vapor-phase sample.

By combining the PIMS and GC measurements, they evaluated the auto-ignition reactivity of the reformates, with the help of simulations employing detailed chemical kinetic models.

"The reformate generally sped up auto-ignition when blended with the unreformed parent fuel," Isaac says, and the team was able to identify a handful of chemical species responsible for the speedup.

They incorporated these results into a simplified engine-cycle model that accounted for the increase in charge-specific heat ratio from the low-molecular-weight reformate constituents and the charge-cooling effect from the main-period fuel injection event. The model demonstrated that increasing the amount of reformate for the gasoline surrogate sped up compression-induced auto-ignition. The researchers said the model agreed well with performance data from the research engine, where they observed that NVO fueling substantially improved combustion stability.

Moving away from overly simplified models

"Predicting the composition of the NVO-period reformate stream continues to be a challenge," Isaac says. "Although conventional engine combustion simulations can accurately model flow dynamics, they typically rely on overly simplified combustion models that do not represent the full range of chemical pathways."

The simplified combustion models do not accurately predict the small concentrations of those constituents that had major impacts on auto-ignition characteristics, however. The team is working with University of Minnesota researchers, who are using the Sandia measurements as benchmark datasets for stochastic reactor models. Those models use simplified mixing models in conjunction with detailed chemical kinetic mechanisms to predict the NVO-generated reformate stream composition.

This research contributes to Sandia's Combustion Research Facility mission of providing the combustion science and technology base needed to meet US energy needs in an environmentally responsible manner.

PECASE is highest US honor for early-stage researchers

Melissa Teague awarded Presidential Early Career Award

By Neal Singer

Materials engineer Melissa Teague (1851) has been awarded a Presidential Early Career Award in Science and Engineering (PECASE), the highest honor the US government bestows on science and engineering professionals in the early stages of their independent research careers.

Melissa was recognized for pioneering improved characterization of mixed uranium and plutonium oxide after it has been used as fuel in a nuclear reactor for an extended time — a condition called "high burn-up." Developing and applying advanced examination techniques for high-radiation samples, she used an ion beam to prepare successive thin sections of the fuel, characterized each section, and then reconstructed the three-dimensional sample for further study.

MELISSA TEAGUE is a 2016 recipient of a Presidential Early Career Award in Science and Engineering for pioneering improved characterization of mixed uranium and plutonium oxide after it has been used as fuel in a nuclear reactor for an extended time. (Photo by Randy Montoya)

"These experimental activities are groundbreaking for their first-of-a-kind data obtained on high burn-up MOX [mixed oxide nuclear reactor] fuel, and the first three-dimensional reconstruction of irradiated fuel," wrote recently retired DOE assistant secretary for nuclear energy Peter Lyons in support of Melissa's PECASE application. "Furthermore, this technique was applied to fast-reactor MOX fuel that has the highest burnup known, providing data that is highly relevant to domestic and international advanced fuel programs."

Working at the mesoscopic level

Her work at Idaho National Laboratory was done at the mesoscopic level, a relatively underexplored range compared with atomistic and macroscopic investigations of fuel behavior.

Melissa signed on at Sandia less than a year ago, and looks forward to exploring a wide range of materials here.

But she's no stranger to Sandia. As an undergraduate in ceramic engineering at the University of Missouri-Rolla, she was mentored by Tina Nenoff (1100) and Margaret Gordon (6124) in summer 2004, growing and testing zeolite membranes, and by now-retired Ron Loehman in 2005, with whom she tested a variety of glass-steel seals. She also met her future husband, Albuquerque native Michael Teague (2997), during that time. The presence of grandparents, including recently retired Sandia employee Tommy Teague, to help raise the couple's three young children made Albuquerque especially attractive.

"I'm happy to be a role model to show that a woman with three children can succeed in her work," she says.

She made an early stop at the Knolls Atomic Power Laboratory before joining Idaho National Laboratory (INL), where she worked from 2010 to 2015 while earning her doctorate in materials science from the Colorado School of Mines. At INL, she was appointed deputy director for the laboratory's TerraPower Program, a roughly $10 million-a-year project that examined the feasibility of traveling wave nuclear reactors as part of a cooperative research and development agreement (CRADA) with TerraPower Inc., a Bellevue, Washington, start-up. The proliferation-resistant reaction breeds its own fuel, using the wave of extra neutrons from fissioning uranium-235 to transmute uranium-238 to plutonium-239.

40 years instead of two

"The reaction only enriches as it goes," she says. "It breeds Pu-239 as it burns it. Since it enriches its own fuel, it can last for 40 years instead of the standard two, so you don't have to transport fuel back and forth as often."

The private company has announced plans to build a demonstration plant in China.

Among Melissa's awards are the Massachusetts Institute of Technology's Rising Star Award in Nuclear Science and Engineering, the Young Scientist Award from the European Materials Research Society and the DOE Nuclear Energy Enabling Technologies award, meant to further the close integration of experimentation with mesoscale modeling.

Her PECASE award, while unaccompanied by a stipend, "should make it easier to get funding" for her work analyzing brittle materials, providing data for modelers, and testing their simulations, she says.

State office honors Conrad James, Theresa Carson

By Rebecca Brock

Two Sandians have been named recipients of 2016 Outstanding Service Awards from the New Mexico Office of African American Affairs (OAAA). Accomplished research engineer Conrad James (1714) and supply chain senior manager Theresa A. Carson (10220) have been acknowledged for their strong commitment to improving the quality of life for African Americans in the community. The 13th annual service awards recognize dedication to education, community development, health care advocacy, and economic advancement for African Americans.

New network brings people together

Theresa is acknowledged for creating a professional networking group to benefit African Americans in Albuquerque.

THERESA CARSON

Theresa and Bettye Pressley, former executive director of the Rio Grande Red Cross, cofounded a social initiative to encourage young African American professionals to remain in New Mexico.

"Based on the discussions we had with those new to Albuquerque," Theresa says, "we identified there was a lack of community here for African Americans, thereby causing them to seek job opportunities in other states. We found it important to create a venue to connect the 2 percent of African Americans in our city to network and share information about cultural services and become involved in community activities."

In his nomination letter, Ron Wallace, editor of *Perspective 2 Magazine*, described Theresa as "innovative, dedicated, and community-focused."

Theresa says, "It's an honor to be recognized by New Mexico's Office of African American Affairs. While awards are wonderful, just knowing that we have helped to bring together African Americans within and around Albuquerque to begin the journey of forming an active community that is embracing our new residents is rewarding enough."

> *"It's important to give back. I live by the scriptural verse, 'to whom much is given, much is required.'"*
>
> — Theresa Carson

In the Albuquerque community Theresa has served as a member of the Albuquerque Academy Board of Directors. For the past two years she has volunteered as co-planner for the National Museum of Nuclear Science and History's Discover STEM program and she also serves on three Calvary of Albuquerque Missionary Care Teams. She is the former co-chair of the Black Leadership Committee at Sandia and coordinator for HMTech, the educational outreach program for African American middle school and high school students.

Theresa, who grew up in Albuquerque, says she makes time for community outreach work because "it's important to give back. I live by the scriptural verse, 'to whom much is given, much is required.'"

Improving the community through legislation

Conrad James received the executive OAAA service award for his contributions to statewide policy. While working as a researcher at Sandia, Conrad served as an elected member of the New Mexico House of Representatives from District 24 from 2011-2012 and 2015-2016. In 2013, he was appointed to the University of New Mexico's Board of Regents where he served as vice-chair of the Finance and Facilities Committee and as a member of the Health Sciences Center board of directors.

"Through his work as a legislator, Conrad has been dedicated to the community at large and all communities of color," says Yvette Kaufman-Bell, executive director of the Office of African American Affairs, who nominated him for the award. "He is a champion for education, and has made an impact on policy for our youth, our elders, and our local business owners," she says.

Kaufman-Bell adds, "Conrad is just such a great spirit who deserves to be recognized as he looks to retire this year from his service in state government."

CONRAD JAMES

Conrad says he is honored to receive an award from the Office of African American Affairs. "My time in the legislature and on the UNM Board of Regents was very rewarding, and I am pleased I was able to make a difference in our state. New Mexico has a unique situation where legislators are citizen volunteers, and I really find it to be a great way to get people involved in helping their community, while still remaining a vital part of that community."

Conrad says he enjoys community service because, "I like examining complex problems, and then working in teams to come up with solutions. Policy-making at the state level was a perfect match for my interests."

Conrad's research spans neuromorphic computing, microelectronics, and microfluidic devices. He holds seven patents and has published numerous journal articles.

"My schedule is rather hectic, but as long as you put faith and family first, everything else seems to fall into place," says Conrad.

Sandia/California's showcases engineering, science, and service at 60th anniversary community event

By Michael Padilla

From learning how a full-scale optical engine works to touching actual munitions destroyed by the Explosive Destruction System to watching predators munch on algae in a photobioreactor, the community got a rare glimpse into Sandia/California at an event in downtown Livermore on May 21.

The more than 500 community members who attended viewed 18 displays and met with more than 30 Sandia researchers, engineers, and scientists. The program included remarks from Sandia President and Labs Director Jill Hruby and Marianne Walck, VP of Sandia's California site and the Labs' Energy and Climate program. US Rep. Eric Swalwell, D-Calif., Assemblywoman Catharine Baker, Alameda County Supervisor Scott Haggerty, Livermore Mayor John Marchand, and Lawrence Livermore National Laboratory Deputy Director Thomas Gioconda all congratulated Jill andMarianne on the anniversary and shared their connections with Sandia/California.

Sandia systems analyst and engineer Jarret Lafleur (8118) gave a talk on "The Perfect Heist" and Cybersecurity R&D Manager Levi Lloyd (8965) spoke on "Cybersecurity: Challenges and Opportunities in the Digital Age."

The event brought together Sandia's education outreach programs with hands-on scientific activities from Family Science Night and Expanding Your Horizons volunteers. A local Girl Scout robotics team demonstrated its favorite robots and Livermore High School Green Engineering Academy students displayed their "Seniors helping Seniors" engineering projects. Activities included making molecules using miniature marshmallows, creating miniature robots, and, one of the most popular activities, making paper glow using copper tape, LEDs, and watch batteries.

Sandia recruiters discussed careers and job opportunities at Sandia/California with visitors.

Erin Chandler (3553) says the best part of the day was seeing all the young adults interested in internships at the site in the near future.

"Seeing their excitement about engineering and science and the possibility of working at our lab made for a very rewarding day," she says. "Everything went so smoothly and I don't think we should wait another 60 years to have another community event."

This first-of-its-kind event greatly exceeded expectations, both in the number of attendees and the level of interest from the general public.

"This was the first time that we have had a lab-wide event out in the community," Marianne says. "It was terrific to see so much passion and dedication for our work displayed at the event, and I look forward to our continuing outreach in the community."

FUEL CELL ON THE GO — Sandia Labs Director Jill Hruby and Marianne Walck, vice president of Sandia's California site and the energy and climate program, talk about fuel cell vehicle research with Juan Contreras of California's Fuel Cell Partnership at the 60th anniversary event. (Photo by Dino Vournas)

BRUSH BOTS — A Girl Scout robotics team demonstrated its favorite robots at a Sandia/California celebration in Livermore. Children of all ages — and adults —— were able to make miniature robots using toothbrush bristles. (Photo courtesy of the Girl Scouts)

MIGHTY ENGINE — A young visitor turns the crank on an engine that was on display at the 60th anniversary. (Photo by Dino Vournas).

The wild blue yonder

Photos by Randy Montoya

Tens of thousands of New Mexicans turned out on Saturday and Sunday, June 4-5, to help Kirtland Air Force Base celebrate its 75th anniversary with an air show and ground displays. Aircraft on the field, many of which were opened to allow visitors to walk through and even sit in the pilot's seats, included the latest, most modern planes in the Air Force inventory as well as vintage aircraft that earned a proud heritage of defending the nation during times of war and peace. KAFB has been the home of Sandia dating back to the days when the Labs was known as Z Division and was still part of Los Alamos Laboratory (as it was then called).

In the photos here clockwise from top, *Sentimental Journey,* a World War II-vintage B-17G, makes a memorable flyover; a T-6 Texan trainer, introduced in the 1940s and in active service until the 1970s, performs aerobatic maneuvers; two C-130s, which have been in the Air Force inventory since the 1960s, fly in close formation; crowds of people explore the cavernous cargo space of a C-5 Galaxy, one of the world's biggest planes; a futuristic-looking B-2 stealth bomber makes a pass over the airfield; and a member of the Wings of Blue parachute demonstration team makes a dramatic entry onto the airfield.

Know-how now

DRONE TECHNOLOGY — Dave Walker, chief operating officer of Silent Falcon UAS Technologies Inc. of Albuquerque, worked with a team of Sandians on smart battery software, hardware, programming, and chemistry for his company's electric-powered drones. "No single company has all the expertise," Walker says. "Sandia has all the disciplines in one place." (Photo by Norman Johnson)

Small companies grow with a technical leg up

By Nancy Salem

Imagine driving a car down the highway with no fuel gauge and no idea how big the gas tank is. You want to go as far as possible before filling up but not so far that you sputter to a halt. "That's what it's like to operate an electric plane or robot or other device that relies on a lithium battery," says Albuquerque businessman Greg Walker. "I wanted a technology to show how much power such a battery has at any particular time."

Walker is the chief operating officer of Silent Falcon UAS Technologies Inc., which makes electric-powered drone aircraft. The company found four other small New Mexico businesses that use battery technology in everything from robots to motion picture filming. They joined forces to develop a technology to monitor the health of battery packs for all kinds of unmanned vehicles. "Lithium batteries in aircraft and robots are big," Walker says. "Our challenge was to push the battery as far as possible but not crash."

The group needed help and reached out to the New Mexico Small Business Assistance (NMSBA) Program, a public-private partnership among Sandia, Los Alamos National Laboratory, and the state of New Mexico that connects small business owners with scientists and engineers who provide technical assistance.

They were teamed with Sandia electrical engineer Von Trullinger (5335) and materials scientist Dan Weskolowski (2545) who, during the past year and a half, have improved the monitoring electronics and algorithms embedded in the battery hardware. They also advanced software designed to communicate with device operators through a web page or Ethernet connection. Users can now monitor battery condition and historical data, and plan even more complicated missions.

The companies, which have received $2 million in new investment and added nine employees since working with Von and Dan, were among 366 small businesses in 24 counties that participated during 2015 in NMSBA. The program also contracts with the New Mexico Manufacturing Extension Partnership, University of New Mexico (UNM) School of Engineering, and the Management of Technology program at the Anderson School of Management, Arrowhead Center at New Mexico State University (NMSU), and the New Mexico Tech Department of Management. NMSBA provided $4.77 million worth of assistance to New Mexico small businesses in 2015.

Learn more

NMSBA
Los Alamos National Laboratory
Sandia National Laboratories
Solving New Mexico's Small Business Challenges

For more information about NMSBA,
call Genaro Montoya at (505) 284-0625
or visit www.NMSBAprogram.org.

10 projects

Ten projects that achieved outstanding innovations through the program in 2015 were honored last month at NMSBA's annual Innovation Celebration Awards event at Sandia Golf Club.

Silent Falcon's Smart Battery Manager, along with Tibbar Plasma Technologies, received the Honorable Speaker Ben Luján Award for Small Business Excellence as the honorees that demonstrated the most economic impact.

"NMSBA has been bringing small businesses together with scientists and engineers from Sandia and Los Alamos national laboratories for more than 15 years. This is a phenomenal way to assist small companies that don't have the resources to do advanced research and development," says Jackie Kerby Moore, manager of Technology and Economic Development Dept. 1933. "National laboratory expertise helps these business people realize their dreams, and stimulates our state's economy."

A market for unmanned vehicles

The global market for unmanned vehicles was $2.29 billion in 2015 and is estimated to reach $4 billion by 2020. Silent Falcon and four companies in a small-business cluster at the Alamogordo Science and Technology Park want to capture a piece of that market by developing advanced unmanned mobile robots.

Two of the companies, Emerging Technology Ventures Inc. and North Alabama Robotic Systems Inc., make unmanned vehicles for land, air, and sea. Motion Picture Marine Inc. uses unmanned vehicles to create sequences for motion pictures like X-Men, Armageddon, and Star Trek. American Lithium Energy Corp. makes lithium-ion batteries that power unmanned vehicles.

Walker says the battery management technology would not have been possible without the help of a Sandia team assembled by Von working in software, hardware, programming, and battery chemistry. "The first year was about getting the hardware together and building circuits," Walker says. "This year we're looking at what breaks a battery. How healthy is it? How do you know when a battery is being worn out?"

Walker says the Smart Battery Manager is being used by other partners and will be in place in his company's planes later this year. "Everything about the technology is getting better," he says.

Powerful transformers

Tibbar Plasma Technologies Inc., the other Ben Luján Award winner, worked with Los Alamos National Labora-

(Continued on next page)

Transforming tragedy into good practices

Los Alamos Lab accident focus of lessons learned forum during Electrical Safety Month

By Karli Massey

May 3, 2015, an electrical substation was undergoing maintenance and cleaning at Los Alamos National Laboratory (LANL);. An electrical worker, intending to do a thorough job, opened a panel that he didn't realize was energized. When he sprayed a cleaning fluid on the equipment, an electrical breakdown resulted in an arc flash and blast The worker received third degree burns over 30 percent of his body and was airlifted to Albuquerque for emergency treatment. Eight other individuals at the substation were also hospitalized. After an extended recovery period, the critically injured worker recovered and has returned to work at LANL.

Since that incident, much work has been done to understand what led up to the event and how such accidents can be prevented in the future across the DOE complex.

This year, during an electrical safety fair at the Steve Schiff Auditorium on May 18, Sandia hosted Lloyd Gordon, LANL's chief electrical safety officer, to share lessons learned and discuss the enhancements that were made to its safety program as a result. Five other LANL workers also attended to share information about the incident.

Just as many people clearly remember what they were doing when the Challenger exploded in 1986 or the events of Sept. 11, 2011, Gordon said the news of the May 3 incident, and especially the fact that fellow LANL employees were injured, perhaps critically, was seared into his memory.

In the investigations that followed, among the findings were weaknesses in worker practices, confusion related to look-a-like equipment, and the lack of robust zero-energy verification. In addition to improvements to LANL's electrical safety program and its training regimen, the increased focus on Human Performance Improvement (HPI) concepts have also strengthened the safety culture across the lab.

"Our goal is that every employee sets the example. We are encouraging 'leadership for all,'" Gordon said, adding that LANL is working to fully implement other HPI tools. In addition to encouraging workers to have a questioning attitude, stopping work, and recognizing hidden hazards, the Lab is employing both pre-job risk assessments and real-time risk assessments.

"This different approach to looking at risk assessments is going to change the way we approve electrical work and prevent injuries," he said. "Workers and planners alike need to apply risk assessments at the site while the work is being done.

"Lessons from this accident are also just as relevant to researchers," Lloyd added. "You can make the same mistakes no matter what work you do."

Dan Pellegrino, assistant manager of the NNSA Sandia Field Office, also addressed the audience during the forum. "I'm hopeful that during this focus time on electrical safety, you will hear something that will stick and it will be just enough to prevent an accident" he said.

Dan also added, "Sandia's desire to share lessons, and more importantly, the desire to learn from missteps — their own and others — have helped drive improvements in safety."

Electrical safety incidents at Sandia were reduced by nearly 50 percent from 2014 to 2015. "We've made great strides in preventing injuries from electrical events," ES&H acting deputy director Natalie Cater (4130) says. "That is why commemorating Electrical Safety Month is one way to maintain that momentum."

The goal and purpose of commemorating National Electrical Safety Month each May is to reduce the occurrence of electrically-related fires, fatalities, and injuries by reinforcing messages that will resonate with workers and their families. Electricity has become such a necessary part of our lives that we tend to take it for granted, but using it safely is vitally important — both on the job and at home.

Interested in learning more about Human Performance Improvement?	
Fundamentals of Human Performance (HPI 100)	Upcoming Courses: June 28, Sept. 15
Managing Human Performance (HPI200)	Upcoming Course: July 13

View the May 18 Lessons Learned Forum & access safety resources at LiveSafe.sandia.gov

Innovation Celebration

(Continued from preceding page)

TRANSFORMERS — Richard Nebel, president of Tibbar Plasma Technologies Inc., worked with Los Alamos National Laboratory to develop plasma-based AC-DC transformers that can significantly cut the cost of transmitting electrical power. The Los Alamos company has hired 10 new people and completed machine development to manufacture the transformers.

(Photo by Sandra Valdez, LANL)

tory's Juan Fernandez to develop plasma-based AC-DC transformers that can significantly cut the cost of transmitting electrical power. The technology also allows electricity to be transmitted over long distances, as far as 1,200 miles compared to the current maximum of 400 miles.

Tibbar in 2015 received a $3.5 million contract from the DOE Advanced Research Projects Agency-Energy. The Los Alamos company has hired 10 new people and completed machine development to manufacture the transformers.

Projects recognized at celebration

Here are some other projects recognized at the Innovation Celebration:

• **IR Dynamics of Santa Fe** worked with Sandia to develop thermochromic materials for control of infrared transmission that could be used as pigment additives for smart windows or pigment-based coatings in architecture, transportation, and clothing. Company President William Kurtz worked with Sandia's Raegan Johnson (1816), Nelson Bell (1815), and Paul Clem (1353) to determine the feasibility of manufacturing such coatings. IR Dynamics subsequently raised $600,000 in private equity funding, secured $100,000 in grants, and got a $1.95 million DOE grant.

• David Cook worked in supply chain operations for 15 years and watched hundreds of businesses try to solve inventory challenges with spreadsheets. He founded **Right Sized Inventory** to create a computer-driven analysis platform that would let users identify and maintain an optimal amount of inventory for any item in any location. Sandia's Andy Scholand (5792) made the software more accurate and dependable, allowing customers to refine their inventory analysis. The Albuquerque company has boosted revenues by $50,000 since rolling out the improved software.

• **bioLime** has developed a modern version of lime-based structural coatings, or "breathable skin," that make modern buildings more energy efficient, healthier, and longer lasting. Brian Cola, founder and president of bioLime, moved the company from Florida to Santa Fe and, through NMSBA, worked with Scott Bryant of the New Mexico Manufacturing Extension Partnership to identify raw materials and techniques to manage its domestic partners and regional supply chain, saving about $25 million in investment costs.

• Luke Smith was an undergraduate accounting student at NMSU when he founded **EcoSeal** to bring NMX, an environmentally friendly pesticide, to market. Realizing NMX had to be validated in the field to get regulatory approval, he worked with Griselda Martinez of NMSU's Arrowhead Center and the university's Ryan Goss to test the product on turf grass. The work led to a $50,000 I-Corps grant to do more market research to commercialize NMX.

• **Innobright Technologies of Albuquerque** has developed a software package that changes the cost, time, and quality of computer-generated imagery, or CGI. Innobright's Altus software runs 10 times faster than conventional rendering programs and provides high-quality images by applying its patented noise-removal algorithms. Owner Raghu Kopalle worked with Steve Walsh of the UNM Management of Technology program to identify the best markets for the product. Kopalle has since raised $330,000, attracted customers from around the world, and hired six people.

NMSBA launched 16 years ago

NMSBA was created in 2000 by the state legislature to bring national laboratory technology and expertise to small businesses in New Mexico, promoting economic development with an emphasis on rural areas. Since its inception, the program has provided 2,495 small businesses in all 33 New Mexico counties with more than $48.5 million worth of research hours and materials. The program has helped create and retain 4,863 New Mexico jobs at an average salary of $38,768, increase small companies' revenues by $236.2 million and decrease their operating costs by $104.7 million. These companies have invested $97.6 million in other New Mexico goods and services, and received $87.2 million in new funding and financing.

"The small businesses in our group could not have pulled together a team like Sandia did to work on the Smart Battery Manager," Walker says. "No single company has all the expertise. Sandia has all the disciplines in one place. I am a huge fan of NMSBA."

Celebrating innovation

HONG HOU has been named the first inductee in Sandia's Entrepreneurial Hall of Fame. The former Sandian was CEO of EMCORE for many years of growth.

Former EMCORE CEO Hong Hou was honored as Sandia's first Entrepreneurial Hall of Fame inductee during a ceremony at the 7th annual Innovation and Intellectual Property Celebration last month at the Hotel Albuquerque. The annual event, sponsored by Sandia's Partnerships Team, honors the innovative culture and intellectual property generated by Sandia's scientists, engineers, and technologists.

Hou, an electrical engineer who spent his early career at Sandia, left the Labs to expand a semiconductor and solar company, EMCORE, where he led the commercialization of products that stemmed from technologies developed at Sandia. He is credited with building the company into one of the world's leading manufacturers of high-efficiency solar cells and solar panels for space power applications.

At the celebration, awards were given to individuals who received patents and copyrights in calendar year 2015. The event also recognized Mission Innovators, who were nominated by their divisions for innovation in support of Sandia's national security missions. Awards were also presented to director-nominated Up and Coming Innovators, honoring early career Sandians who display potential to make significant contributions to the Labs' intellectual property portfolio.

Mission Innovators

Steve Ball, John Bartholomew, Daniel Bender, Jonathan Berry, Joshua Beutler, Timothy Boyle, Denis Bueno, Robert Butler, David Carter, Michael Clemenson, Adam Cook, William Cordwell, Dylan Crocker, Marshall Daniels, Emily Dougal, Michael Dugger, Daniel Dunlavy, Josh Eads, Travis Wayne Eubanks, Leanne Felix, Kira Fishgrab, John Flory, Adam Flynn, Daniel Gallegos, John Gauthier, Emmett Gurule, Brian Hacsi, Ryan Falcone Hess, Sarah Hostetler, David Karelitz, Brian Kellogg, John Korbin, Garth Kraus, Thomas LeBoeuf, Kelvin Lee, Chris Leger, Timothy Loffredo, Caleb Loverro, David McGrogan, Jason Meeks, Brent Meyer, Steve Montague, Branden Moore, John Mulcahy-Stanislawczyk, Prabal Nandy, Miguel Palaviccini, Kent Pfeifer, Brian Phillips, Todd Pitts, Matthew Reading, Alex Robinson, Jose Rodriguez, Karl Schrader, Richard Schroeppel, Jason Shepherd, Eric Shields, John Siirola, Severiano Sisneros , George Sloan, Norm Smith, Grant Soehnel, Jason Sonnek, Mark Torgerson, David Turner, Christopher Valicka, Jonathan Van Houten, Cynthia Veitch, Trinh Vu, Dan Wahl, Chris Wampler, Austin Wareing, David Wheeler, David Yocky

Patents

Kathleen Alam, Todd Alam, David Aldridge, Andrew Allerman, Travis Mark Anderson, Stanley Atcitty, Larry Bacon, Todd Bauer, Daniel Bender, Douglas Bickel, Grant Biedermann, Timothy Bielek, Nicolas Bikhazi, David Bossert, Gerald Boyd, Timothy Boyle, Patrick Brady, Darren Branch, Igal Brener, C. Jeffrey Brinker, Jason Brown, Charles Bryan, Diana Bull, David Bruce Burckel, Leo Bynum, Liam Claus, Abraham Anthony Clements, Edward Cole Jr., Jonathan Albert Cox, Julia Craven, Mary Crawford, Paul Davids, Jennifer Depoy, Christopher DeRose, Mark Derzon, Thomas Dewers, Shawn Dirk, Bruce Draper, Kevin Dullea, Randy Duvall, Gregory Conrad Dyer, Travis Wayne Eubanks, Hongyou Fan, Jeffrey Farrow, Justin Ford, Paul Galambos, Terry Garino, Justin Garretson, Christopher Gibson, Thomas Gladwell, Mark Gramann, Karl Douglas Greth, Vipin Gupta, Thomas Gurrieri, Jason Hamlet, Dulce Hayes, Jason Heath, Ryan Helinski, Michael David Henry, Clifford Ho, Clinton Hobart, Jeromy Hollenshead, Peter Hotchkiss, Alexander Hsia, David Ingersoll, Joshua Jacob, Conrad James, Robert Jarecki Jr., Adam Jones, David Alexander Jones, Randolph Kay, Michael Aaron King, John Klem, Jessica Nicole Kruichak, Eric Langlois, Kurt Larson, Anthony Lentine, Scott Lindblom, Hung Loui, Ting Luk, Frank Maldonado, Laura Martin, John Mason, Michael Mazarakis, Jaime McClain, Hayden James Evans McGuinness, Bion Merchant, Mary Miller, Mark Monda, Ines Montano, John Mulder, Stephen Neidigk, Jeffrey Nelson, Tina Nenoff, Hung Nguyen, Roy Olsson, David Peters, Ronen Polsky, Harry Pratt, John Reno, Paul Resnick, Robert Riley, Dennis Roach, Alex Robinson, Bobby Rush, Carlos Anthony Sanchez, Dorina Florentina Sava Gallis, Darwin Serkland, Eric Shaner , Subhash Shinde, Chad Staiger, Bernd Strassner II, William Stygar, Ganapathi Subramanian Subramania, William Sweatt, Paiboon Tangyunyong, Anna Tauke-Pedretti, John Teifel, Gregory Ten Eyck, Jorge Mario Urrea, Jonathan Roger Van Houten, Paul Vianco, George Wang, Yifeng Wang, David Wheeler, Jason Wheeler, David Wilson, Jeremy Benjamin Wright, Yongliang Xiong, Travis Ryan Young, William Zortman

SANDIA CHIEF TECHNOLOGY OFFICER and Div. 1000 VP Rob Leland (left) with Up and Coming Innovator award recipient Miguel Alejandro Aguilo Valentin.

Copyrights

Bryan Arguello, Christopher William Stuteville Bruner, David Crawford, Kendall Depriest, Gerald Gallegos, Jared Lee Gearhart, Katrina Groth, Daniel Robert Guildenbecher, David Hensinger, Roger Martin Kilgore, Leonard Malczynski, Jack Mizner, Stewart John Mosso, Max Robert Ottesen, Howard Passell, William John Peplinski, Sharon Petney, Nathaniel Roehrig, Robert Schmitt, Alexander Joseph Sloboda, Teresa Torres, Douglas Vetter, Daniel Villa, Greg Walkup

Up and Coming Innovators

Thomas Beechem, Patrick Burton, Christopher Cassano, Adam Cook, Amber Dagel, Alex Dessanti, Erica Douglas, Kurt Ferreira, Summer Ferreira, Eric Forrest, Kyle Fuerschbach, Jason Hamlet, Edward Jimenez, Christopher Kelley, Sungtae Kim, Kevin Knotts, Jacob Leemaster, Edward Matteo, Kyle Merry, Victoria Ragsdale, Blake Reece, Kyle Solis, Ryan Steinbach, David Stracuzzi, Miguel Alejandro Aguilo Valentin, Gregory Von White, Gregory Wainwright, David Wilson

Recent Patents

Note: Patents listed here include the names of active and retired Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing for each patent is a patent number, which is searchable at the US Patent and Trademark Office website (www.uspto.gov).

* * *

Shawn M. Dirk (2241): Polymer Scaffold Degradation Control Via Chemical Control. Patent No. 9,228,042.

William A. Zortman (5645): Thermally Tuneable Optical Modulator Adapted For Differential Signaling. Patent No. 9,235,065.

James G. Chow (5349) and Mark W. Koch (5448): Terrain Detection and Classification Using Single Polarization SAR. Patent No. 9,239,384.

Anthony L. Lentine (1765): Athermalization of Resonant Optical Devices Via Thermo-Mechanical Feedback. Patent No. 9,239,431.

Susan Rempe (8635): Bio-mimetic High-flux Selectively Gas-permeable Membranes. Patent No. 9,242,210.

Anup K. Singh (8600): Systems, Devices, and Methods for Agglutination Assays Using Sedimentation. Patent No. 9,244,065.

Kevin H. Brown (5553), Peter G. Stromberg (5556), Mathew Napier (5556), Tammy D. Henson (5783), and Seferino Crollett (5786): Gimbaled Multispectral Imaging System and Method. Patent No. 9,244,264.

Michail A. Gallis (1513), John R. Torczynski (1513), Anthony S. Geller (1516), and Leonard E. Klebanoff (8367): Particle Control Near Reticle and Optics Using Showerhead. Patent No. 9,244,368.

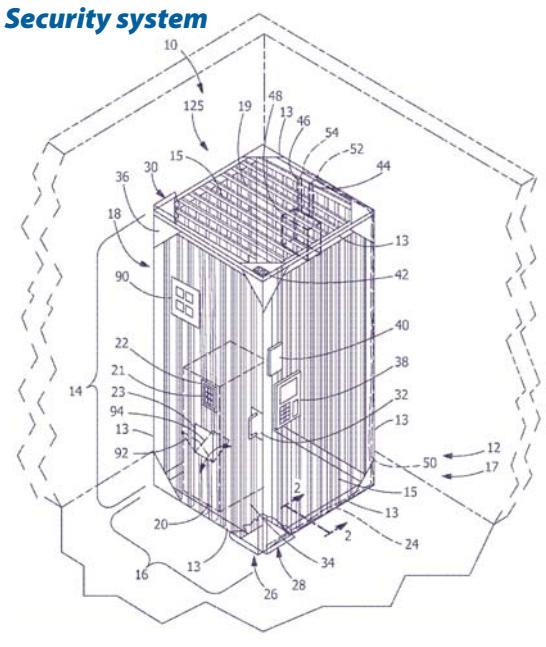
Jon Ihlefeld (1816): Voltage Tunability of Thermal Conductivity in Ferroelectric Materials. Patent No. 9,255,347.

Gerald M. Boyd (5355) and Jeffrey Farrow (8113): Protocol for Communications in Potentially Noisy Environments. Patent No. 9,258,244.

Jeffrey P. Koplow (8366): Axial Flow Heat Exchanger Devices and Methods for Heat Transfer Using Axial Flow Devices. Patent No. 9,261,100.

Mark J. Monda (6532), Clinton G. Hobart (6532), and Thomas S. Gladwell (6532): Precision Disablement Aiming System. Patent No. 9,261,337.

Security system



Michal Kuca (6811) and Mark J. Baumann (6815) Patent No. 9,251,678.

Jonathan Albert Cox (5621): Methods of Producing Strain in a Semiconductor Waveguide and Related Devices. Patent No. 9,261,647.

David G. Wilson (1353): Customized Electric Power Storage Device for Inclusion in a Collective Microgrid. Patent No. 9,263,894.

Matthew F. Barone (1515) and Joshua Paquette (6121): Aeroelastically Coupled Blades for Vertical Axis Wind Turbines. Patent No. 9,267,490.

Ryan Camacho (1131), Robert L. Jarecki, Jr. (1746), and Jonathan Albert Cox (5621): Guided Wave Opto-Acoustic Device. Patent No. 9,268,092.

Ryan Camacho (1131): Methods and Apparatus of Entangled Photon Generation Using Four-Wave Mixing. Patent No. 9,268,195.

Nathalie Joelle Le Galloudec (8238): 3D Target Array for Pulsed Multi-Sourced Radiography. Patent No. 9,269,524.

Jon Ihlefeld (1816) and Harlan James Brown-Shaklee (1816): High ZT Bismuth-Doped Perovskite Thermoelectrics. Patent No. 9,269,880.

Roy H. Olsson (1719): Apparatuses and Methods for Tuning Center Frequencies. Patent No. 9,270,281.

Mark C. Grubelich (6916): Gas Powered Fluid Gun With Recoil Mitigation. Patent No. 9,272,296.

C. Jeffrey Brinker (1000) and Bryan James Kaehr (1815): Cell-based Composite Materials with Programmed Structures and Functions. Patent No. 9,273,305.

Christopher K. Wojahn (5321): Processing Device with Self-Scrubbing Logic. Patent No. 9,274,895.

Karl Scott Hemmert (1422) and Michael J. Levenhagen (1423): NIC Atomic Operation Unit with Caching and Bandwidth Mitigation. Patent No. 9,275,003.

Arthur J. Fischer (1117), Jeffrey Y. Tsao (1120), George T. Wang (1126), and Xiaoyin Xiao (1714): Quantum-Size-Controlled Photoelectrochemical Etching of Semiconductor Nanostructures. Patent No. 9,276,382.

SANDIA CLASSIFIED ADS

MISCELLANEOUS

SURROUND SOUND SPEAKERS, Klipsch, used 1 yr., in original boxes, still under warranty, $1,100 OBO; washer/dryer, $250; bookcases, books. Ulibarri, 417-1154.

CRADLE & SWING, Fisher Price, $50; crib & changing table, great condition, $150/both. Marquez, 401-6525.

GARAGE/ESTATE SALE, Fridays until everything sold, tools, power saws, vintage truck & jeep, 1119 McMullen NW. Wendt, 505-345-6910.

SOFA, Ethan Allan, cream colored, 84" x 38", paid $1,100, asking $150; call for photo. Gerry, 243-5103.

BEDDING/TOWEL DORM SET, 16-pc., unopened, extra-long sheet, rose/black lattice pattern, comforter, etc. $110. Summerlin, 275-3703.

COFFEE TABLE, black, wrought iron, $400; matching end table, $300; both w/brown granite tops. Drebing, 293-3335.

OAK FURNITURE, vintage, Brandt Ranch, hutch/buffets, chairs, beds, desks & more, great condition, photos available. Maxwell, 268-0144, ask for Jim.

COMPUTER & NINTENDO, Dell Inspiron mini, case, charger, $120; Nintendo DS Lite, charger, 16 games, $60. Glover, 505-440-0823.

RECEIVER, Onkyo A/V, 5.1 channel, surround sound, 2 rear, 2 front & center speakers, w/remote & manual, $175. Pelletier, 884-3726.

ENTERTAINMENT CENTER, solid oak, $200; new treadmill, $200; elliptical, $100; Esta Bain figurines, beautiful. Anello, 238-9335.

SPEAKERS, B&W, model 802 series 80, $900; DM570, $150. Wolf, 750-0080, ask for Mike.

WASHER & ELECTRIC DRYER, Whirlpool, great condition, $250/set. Baggett, 505-463-4260.

MINI DACHSHUNDS, black female & male, black & grey dapple male, in Sandoval Co. Gallegos, 239-1799.

MATTRESS, Comfort Select, California king, w/oak frame, 6-drawer pedestal, excellent condition. Wolf, 856-8539.

PUSH MOWER, Fiskars, used twice, almost new, great condition, $50. Colgan, 344-3776.

TWIN BED & FRAME, $100; 3-CD/cassette stereo, $50; 32-in. LED TV, flat screen, HDMI ports have minor glitch, $75. Mann, 505-604-4236, ask for Brandon.

OFFICE DESK, 72" x 38" x 29", w/matching lateral file cabinet, 82" x 20" x 29", fair condition, heavy, you haul, free. Dai, 505-990-9116.

CLOCKS, antique & vintage, working, serviced, excellent condition, check Albuquerque Craigslist post ID 5617637920. Ross, 332-0659.

UPRIGHT PIANO, black, plays beautifully, w/bench, $1,800 OBO; GE Monogram refrigerator, like new, $1,600. Howard, 505-750-3571.

TRANSPORTATION

'08 FORD ESCAPE XLT, 4WD, V6, 4-dr., leather, sun roof, 112K miles, good tires, well maintained, $6,500 OBO. Manzanares, 505-385-6265, ask for Barbara.

'06 JEEP COMMANDER LIMITED EDITION, 4WD, V8, 4.7L engine, leather, sun roof, 160K miles, $10,500. Murrieta, 520-249-6176.

'00 DODGE RAM PICKUP, 4x4, 1500 Lariat SLT, black, extended cab, leather, power, AC, tow pkg., 215K miles, $2,850 OBO. Larson, 286-8237.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.
Submit by one of these methods:

- **EMAIL: Michelle Fleming (classads@sandia.gov)**
- **FAX: 844-0645**
- **MAIL: MS 1468 (Dept. 3651)**
- **INTERNAL WEB: On internal web homepage, click on NewsCenter, then Classified Ads.**

If you have questions, call Michelle at 844-4902.
Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

'06 HONDA ELEMENT, 2WD, 5-spd., black, 113K miles, excellent, $7,850 OBO. Rajan, 505-323-6633.

'08 PRIUS, level 4 pkg. plus extras, original owner, service records available, 61K miles, $8,400. Caskey, 291-3445.

'72 GMC SIERRA GRANDE 2500, 2WD, long bed, 402 ci AT, AC, new cluster, PS, PB, $2,900 OBO. Sammons, 505-710-6859.

'63 VW BEETLE, rebuilt motor, new blue paint, interior, tires, brakes, etc., must see to appreciate, $6,500. Osuna, 505-339-4110.

'08 HONDA CIVIC EX, 4-dr., AT, sun roof, 106K miles, good condition, $7,500 negotiable. Brown, 818-9474.

'16 SUBARU WRX, 6-spd., dark gray metallic, 3.3K miles, priorities changed, $24,500 OBO. Martin, 623-687-7673.

RECREATION

'08 HONDA CBR 1000RR, never down, Repsol fairings, tailor-made exhaust, 14K miles, excellent condition, $6,000 OBO. Holliday, 303-845-0939.

LIGHT SPORT AIRCRAFT, single place, RANS S-14, recent rebuild, $9,500 OBO. Stephenson, 505-260-8223.

'11 29'ER MOUNTAIN BIKE, one-one carbon HT, small, X-Fusion slide fork, XTR/XT brakes shifters, Stan's rims, $975. Kunstadt, 505-270-3707.

'14 YUBA MUNDO CARGO BIKE, 21-spd., fully assembled, brand new condition, all attachments, Kevlar times, $1,500. Loos, 505-503-9255.

'10 JAYCO DESIGNER M-37RLQS 5TH WHEEL, 4 slides, loaded, 16K hitch, <2K miles, excellent condition, $49,000. Linthicum, 505-967-8713.

REAL ESTATE

3-BDR. HOME, 3 baths, updated kitchen, new carpet, 2 living areas, oversized 2-car garage, Terracita, $248,500. Walker, 863-441-3861.

WANTED

MOVING BOXES, all shapes & sizes, will pick up. Sonntag, 505-480-6545.

VOLUNTEERS, & food drive donations for Fabulous Felines cat rescue, see http://www.fabulousfelines.org for details. Stubblefield, 263-3468.

LabNews locations

Lab News is available in news racks at 24 locations throughout the Labs. Delivery to mail drops has been discontinued. A digital version of *Lab News* continues to be available on Tech Web as well as on Sandia.gov.

Lab News Rack Locations:

1. Bldg. 802, elevator lobby
2. Bldg. 810, east lobby
3. Bldg. 822, south entrance
4. Bldg. 858 EL, lobby
5. Bldg. 880, Aisle D, north lobby
6. Bldg. 892, lobby
7. Bldg. 894, east entrance, lobby
8. Bldg. 898, east lobby
9. Bldg. 887, lobby
10. Bldg. 823, lobby
11. Bldg. 836, lobby
12. Bldg. 831/832 north lobby
13. Bldg. 861, Cafeteria lobby
14. Bldg. 870, lobby
15. Bldg. 701, lobby
16. IPOC, lobby
17. CGSC, lobby
18. CRSI, lobby
19. M.O. 308, lobby
20. Bldg. 960, lobby
21. Bldg. 962 (TA III), lobby
22. Bldg. 6585 (TA V), lobby
23. Bldg. 905, lobby
24. 800(A), outside of Vicki's
25. Bldg. 891, lobby

Mileposts

New Mexico photos by Michelle Fleming

Armin Doerry
35 5349

Neil Lapetina
35 413

Debbie Stephens
35 2981

Eden Eager
30 2952

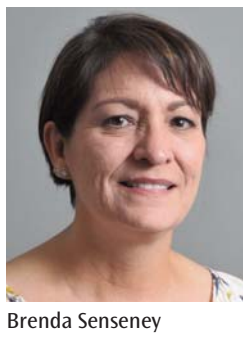
John Williams
30 5353

Joel Lash
20 1670

Tom Cleal
15 9541

Denise King
15 2152

Shauna Moore
15 9548



Brenda Senseney
15 10221

Mark W. Smith
15 5772

Matthew Wong
15 8954

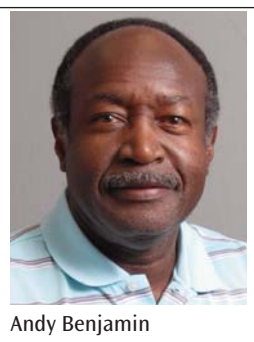
Recent Retirees

New Mexico photos by Michelle Fleming

Mark Montavon
40 5424

Dave Campbell
37 1767

Michael Rouse
36 9542



Andy Benjamin
35 9516

George Baldwin
34 6832

John Campisi
21 857

Getting a lock on it

Sandia's Steve Highland becomes New Mexico's only Certified Master Safe Technician

By Bill Murphy

For Steve Highland, that epic snowstorm in southern Illinois in 1984 was the last straw. As he recalls it, there were 2 feet of snow on the ground in Carbondale, the wind was crazy-bad, and the temperature — not the wind chill factor but the actual air temperature — was minus 20 degrees. And oh, the sewers froze.

The soundtrack of Steve's life at this point could have been Eric Burdon and the Animals' iconic "We gotta get out of this place." Burdon sang in his distinctive, gravelly voice, "We gotta get out of this place / If it's the last thing we ever do / We gotta get out of this place / Girl, there's a better life for me and you."

The young family man knew just what Burdon meant; he and his high-school sweetheart wife were ready for a change.

Steve, who had learned the locksmith trade in the early 1970s through a high school apprenticeship program, started looking around for other opportunities in the trade — in someplace *warm*.

In a trade publication, he learned about a job opening at a safe and lock business in Albuquerque. After looking the place up on a map, and noting that it was well south of Carbondale, he mailed off his resume. The owner was impressed enough that he decided to fly Steve out for a first-hand look. Meeting the young man and assessing his skills, he liked what he saw. So did Steve. He got the job.

The Illinois native moved his family to the sunny Southwest, with an emphasis on sunny.

Great pickings for a locksmith

Over the next 15 years, Steve practiced his craft and continued to hone his skill set. By 1990, he had earned his "certified master locksmith" designation from the Associated Locksmiths of America. The company he worked for did some contract work for Sandia; that was Steve's introduction to the Labs. For a locksmith, Sandia — with its 10s of thousands of locks on vaults, safes, doors, vehicles, desks, and cabinets — was fertile ground. There was always plenty to do and lots to learn. And keeping up with rapidly changing lock technology was always demanding.

DURING THE COURSE OF HIS CAREER, Steve Highland has had to learn about safe technology through the years, from antiques like this 1880s Diebold safe to the most modern high-tech digital devices. (Photo courtesy Steve Highland)

In 1993, Steve started his own locksmith business and continued to do contract work for Sandia. In 2000, he joined the Labs fulltime, while his wife and son continued to run the locksmith business. At Sandia he spent several years doing familiar, if demanding, locksmith duties — everything from rekeying buildings to responding to emergency calls to helping free a distraught employee who somehow locked himself in his office.

'A challenge every day'

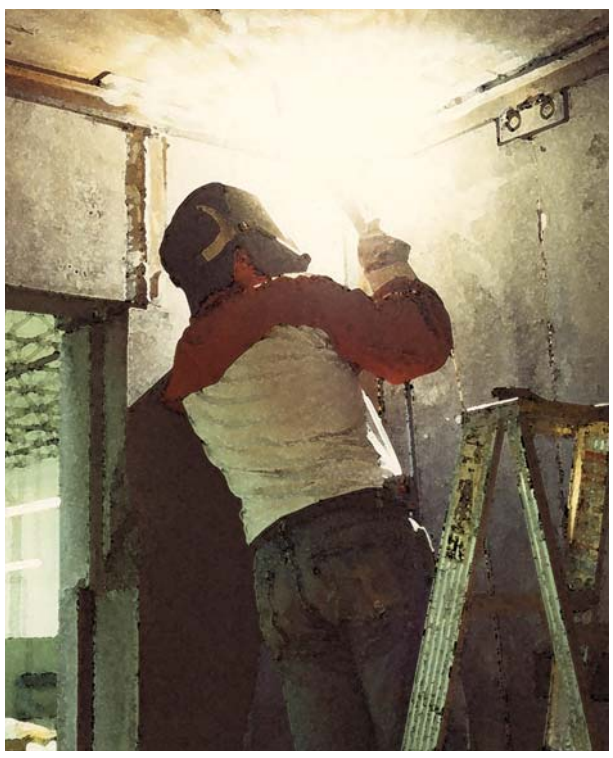
Eventually, with his growing expertise, Steve moved from day-to-day locksmithing chores to Sandia's Access Delay and Structural Assessment organization, which designs safeguards to deny access to critical resources. With his broad and deep knowledge of locks and safes, Steve brought a unique real-world perspective to the team. He knows how locks work and he knows how the bad guys defeat them. He often red-teams security systems, helping the engineers identify vulnerabilities in their designs.

STEVE HIGHLAND, who started at Sandia as a locksmith in 2000, is now part of the Labs' Access Delay and Structural Assessment organization. Steve recently completed course work and exams to become New Mexico's only Certified Master Safe Technician. (Photo by Randy Montoya)

Steve makes a couple of points about physical security: First, a secure system is about much more than a lock in a door; the lock is part of a more complex system. In a sophisticated system, defeating the lock may be the least of a bad guy's problems. He's going to find a lot of surprises on the other side of the lock, and not pleasant surprises.

Steve makes clear, too, that there is really no such thing as an impregnable system — that's the premise behind access delay: You want to have a system that throws up barriers to entry, to slow down the bad guy long enough for a response team to foil the attempted breach. In fact, locks and safes are rated by just this factor: how long it takes a malefactor to defeat the lock using drills, acids, torches, or explosives without damaging or destroying the goods inside.

"It's a challenge every day," Steve says. "I never have boring days. A lot of guys come and consult with me. I love being involved in the design of physical security systems. That's a wide realm and open to a lot of creativity. I love working with my team; they are some smart dudes."



STEVE HIGHLAND WELDS together modular panels for a vault at a jewelry wholesaler in Dallas in the early 1980s. (Photo courtesy Steve Highland)

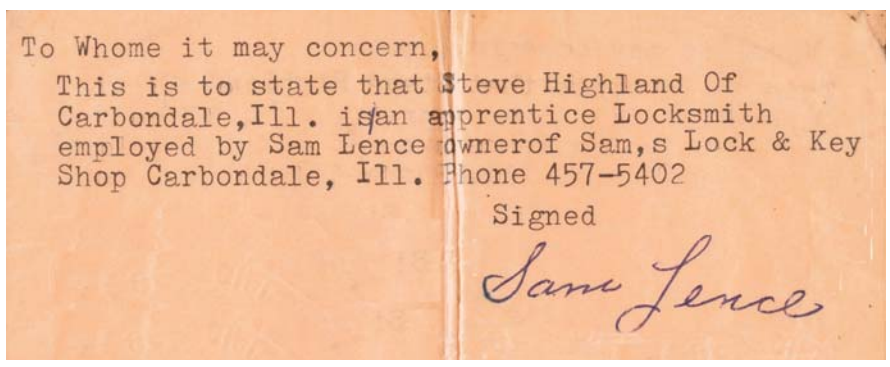
Realizing a long-time goal

As busy as he is, Steve recently completed what for him has been a decades-long goal: he earned his "Certified Master Safe Technician" (CMST) credential, a designation awarded by the Safe and Vault Technicians Association. It's the PhD of the safe and lock world, with a daunting list of course requirements. Here's a small sampling of the skills and knowledge a CMST must demonstrate: troubleshooting and dialing diagnostics; theory of manipulation; drilling; advanced borescope techniques; uncommon safes; high-security safe construction; and lots more.

"The 'master' certification is very tough to achieve," Steve says. "I'm proud to be the only CMST in New Mexico, and I am a Sandian!"

Steve reflects on that first fork in the road that led him to where he is. As a high school senior, he had an opportunity to apprentice in the hospitality industry at a local Holiday Inn but opted for the locksmith program. Looking back, he's glad he did.

"It's my living and my calling," he says.



To Whome it may concern,
This is to state that Steve Highland Of Carbondale,Ill. isan apprentice Locksmith employed by Sam Lence ownerof Sam,s Lock & Key Shop Carbondale, Ill. Phone 457-5402
Signed
Sam Lence

WHEN STEVE FIRST STARTED WORKING as an apprentice locksmith, he was "busted" for trying to break into an empty house. Actually, he was on a job to rekey a vacated property. When the police approached him, he tried to explain what he was doing but the optics weren't good: He was wearing a leather jacket and had lock-picking implements in his toolkit. His boss got him off the hook and typed up the 3x5 card above, signed it and had it notarized. Steve has kept this memento of his adventurous youth for more than 40 years.

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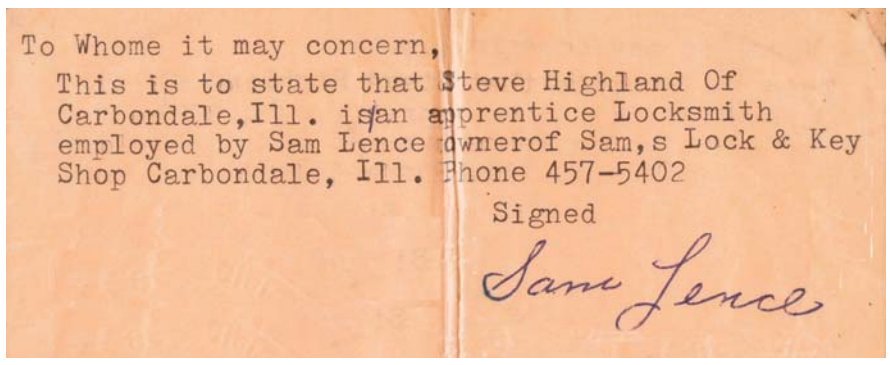

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U.S. POSTAGE
P A I D
ALBUQUERQUE, N. M.
PERMIT NO. 232

SANDIA NATIONAL LABORATORIES
Employee Communications Dept.
P.O. Box 5800
Albuquerque, New Mexico 87185-1468
Electronic Service Requested